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election for Viability In White Leghorns

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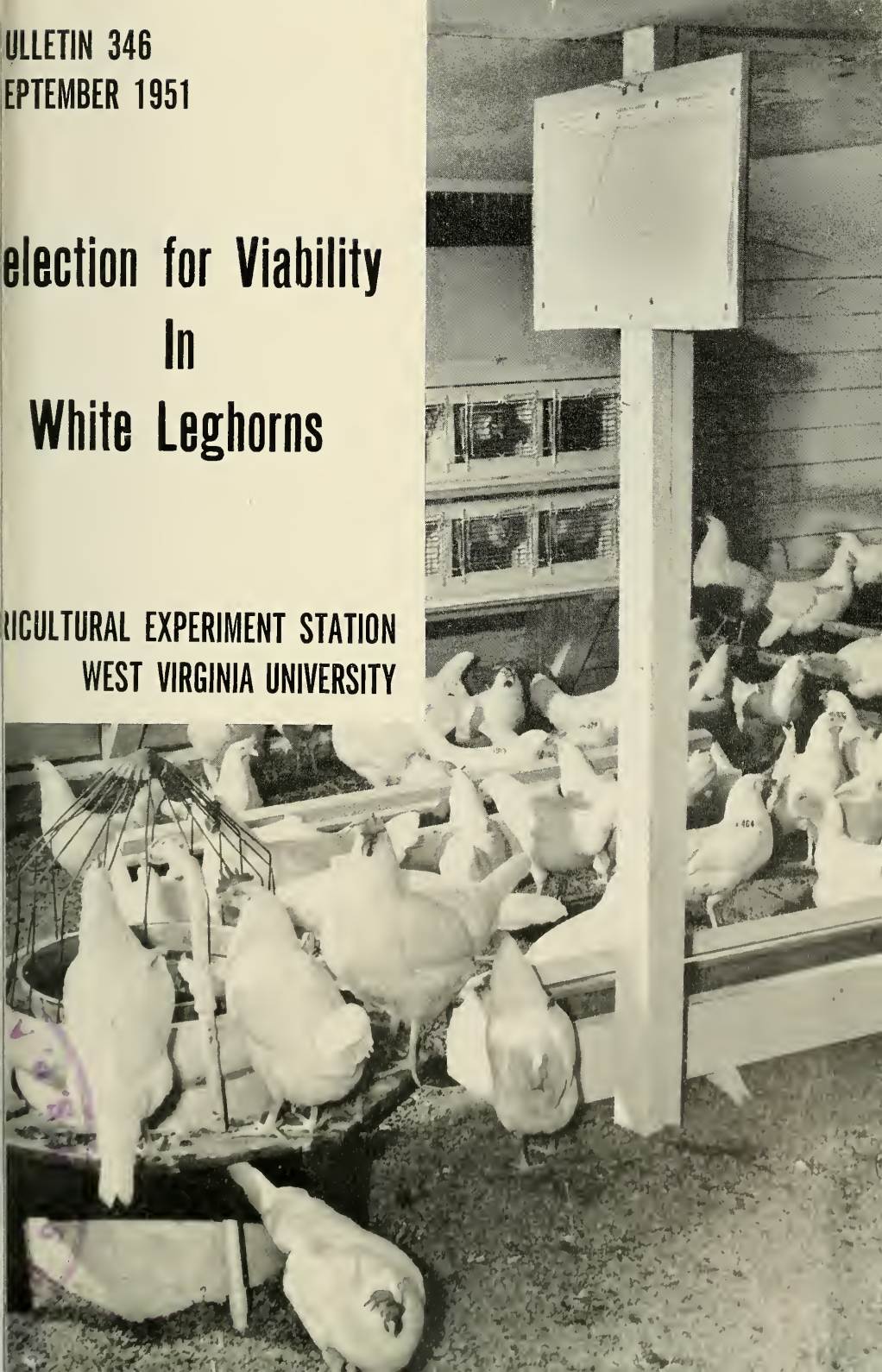

Summary

After ten years of selective breeding for viability in the West Virginia Station White Leghorn flock, a decrease in mortality occurred. This selection started in 1938 when the mortality was 25.2 per cent during the first 280 days of lay. Death losses gradually decreased to 8.5 per cent in 1947.

As the experiment progressed, selection for viability decreased mortality. This decrease was greater during the first half of the laying year than in the second half.

Some individuals showed greater ability to transmit viability to their progeny than others.

After ten years of selective breeding for viability and egg production on a family basis, egg production showed an average increase of 29 eggs per bird for the first eight months of lay.

The results of this study show that an increase in viability and in egg production can be obtained without sacrificing other desired characteristics such as egg size and body size.

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Selection for Viability in White Leghorns

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Poultry diseases and their control are the most serious problems facing poultry growers. Lymphomatosis has probably been the greatest offender during the last two decades. The tenth annual report of the Regional Poultry Research Laboratory, East Lansing, Michigan, shows that lymphomatosis caused a greater financial loss ($60,000,000 annually) than any other poultry disease. As early as 1935 this disease caused great losses in poultry flocks in West Virginia. It appears in various forms and is known by different names, for example, lymphomatosis, leucosis, leucosis complex, fowl paralysis, and big liver disease. Lymphomatosis results in such abnormalties as big livers, enlarged spleens, tumors, lameness, blindness, and enlarged bones. Since the disease resulted in a huge loss to flockowners in the State, it was deemed necessary to study the possibility of reducing death losses from lymphomatosis by selective breeding.

Information indicates that the age of the chicks at the time of exposure and the distance that they are brooded from the source of contamination has an influence on the subsequent death rate of chickens due to lymphomatosis. Kennard (1938) found that isolation of the chicks and the growing pullets from the adult stock reduced mortality and loss from culling during the first laying year. Lymphomatosis was listed among the diseases that caused the losses, but the per cent of loss from the various causes was not reported. Hutt and co-workers (1944) reported that mortality of 160-500 days of age was consistently higher among pullets that had been brooded only 40 feet from adult stock during the first two weeks than among those that had been brooded over 100 feet from adult stock. These investigators reported that much of this difference in mortality resulted from a high incidence of lymphomatosis among the birds brooded within 40 feet of adult stock. Waters and Bywaters (1949) found that 30-day-old chicks, placed with a contaminated population of chickens, showed a statistically significant lower mortality from lymphomatosis than did chickens that were placed with the contaminated population at one day and at ten days of age.

The egg as an agent in transmitting the disease has received some attention. Winton and co-workers (1949) reported that lymphomatosis can be transmitted from the parent stock to the progeny through hatching eggs. On the other hand, Cole (1949) found that dams that died of lymphomatosis during the hatching season or shortly thereafter did not differ from pen-mate controls with respect to neoplastic mortality in their daughters. These results seem to show that if egg-borne transmission of the disease-producing agent from infected breeders does occur, it is not of any great importance in determining the viability of the progeny. Since Cole's evidence does not substantiate that of Winton and co-workers, it seems that more work needs to be done on this problem.

Some birds seem to be more resistant to lymphomatosis than others. Taylor and co-workers (1943) reported that eight years of selection by the progeny test resulted in relatively resistant and susceptible lines of chickens with respect to lymphomatosis. Sturkie (1943) reported that adult mortality in White Leghorns was reduced from 89 per cent in 1935 to 27 per cent in 1940 through selection for disease resistance. He found that approximately two-thirds of the deaths in 1935-36 were due to lymphomatosis. In 1940 less than 14 per cent of the deaths resulted from this cause. Data collected by Marble (1943) in a five-year study show that the selection of breeders from the most viable families of White Leghorns and Barred Rocks resulted in a 50 per cent decrease in laying flock mortality. Bryant (1946) demonstrated that the resistance to disease and the length of life of the domestic fowl can be influenced by selective breeding. Hutt and Cole (1947) reported that during the years 1935-45 they developed by selective breeding two lines highly resistant to lymphomatosis and one line that was very susceptible. Winton and co-workers found that it was possible to develop through selective breeding, lines of chickens that are more resistant to lymphomatosis than other lines.

Experimental

The White Leghorn flock at the West Virginia University Agricultural Experiment Station was used for the study. The project was started in 1938.* The mortality then was about 35 per cent from the time the pullets were housed at about 180 days of age until they had completed the first twelve months in the laying house. Laboratory diagnosis showed that most of this mortality was caused by lympho-

*This project was conducted in 1938-44 by E. T. Wightman, now at the University of Kentucky and Dr. E. N. Moore, now at Ohio Agricultural Experiment Station, Wooster, Ohio.

matosis. Although the selection was done primarily for livability, other important economic factors such as egg number, egg size, and hatchability were considered.

In the study, twelve single-mated breeding pens were used with approximately 180 breeding hens each year. Chicks from these breeding pens were wing banded and brooded in the same brooder houses that were used for brooding chicks prior to this study. At ten weeks of age the pullets and a supply of cockerels from which breeding males were to be selected were moved to range shelters on a grass range. The pullets that were housed at about the time production started were selected by families. No culling was done within families. All pullets of the families that were selected by use of the records were housed when brought in from the range. With few exceptions, not less than four daughters were housed from each dam.

The pullets went through the first year's lay before any were selected for breeders. Mortality and egg production records for the pullets laying year were summarized. The birds that were to be kept for breeders were selected on the basis of these records. The breeder hens were selected primarily on the basis of sib tests. Only pullets that were members of a family of sisters that had a high average performance for the desired characters were kept for breeders. No culling was done in the laying pens except for the year 1945.* All dead birds and those in a moribund condition were sent to the diagnostic laboratory. The most promising breeders, however, were held over for more than one breeding season and a progeny test was obtained on them. Although the study was primarily to investigate the possibility of selecting for resistance to lymphomatosis, it is possible that other weaknesses were reduced since the families with the highest mortality were removed.

Results of Selection for Viability

The laying house mortality results presented herein cover a period of 280 days from the time the pullet laid her first egg in the trap nest. During the last four years of the study, it was necessary to close the pullet laying records about July 1. For uniformity, the results cover the same period for each year of the study.

Data in Table 1 show the per cent of mortality from all causes for each of the years in the study. From these data it can be seen that at the beginning of the study (1938) approximately 25 per cent of the pullets housed died during the first 280-day laying period. For the

*For 1945 approximately 15 per cent of the flock was culled about April 1, due to the scarcity of feed.

Table 1. Laying Flock Mortality, 1938-47

Year Hatched	Number Housed	Mortality		Total Mortality
		1st Half of Period	2nd Half of Period	
		per cent	per cent	per cent
1938	489	12.4	12.8	25.2
1939	506	9.0	13.9	22.9
1940	512	8.5	12.1	20.6
1941	499	10.4	16.2	26.6
1942	715	8.4	9.2	17.6
1943	508	5.0	10.1	15.1
1944	674	6.1	8.5	14.6
1945	516	1.0	5.2	6.2
1946	673	2.9	6.8	9.7
1947	574	1.8	6.7	8.5

Half of period was 140 days.

second and third years there was a slight decrease in mortality, but during the fourth year it increased to 1½ per cent above that of 1938. During the remaining years there was a gradual decrease in the mortality rate. By the tenth year only 8 per cent of the birds died. This was a decrease during the ten-year period of 17 per cent in the mortality rate. In other words, the decrease in birds lost was two-thirds. Table 1 also shows that as the study progressed, the decrease in mortality was greater during the first half of the laying year than it was during the last half.

When the study began, only 6 per cent of the families went through the first laying year with 100 per cent viability. At the close of the study, 50 per cent of the families had 100 per cent viability at the end of the first year's lay. For example, hen No. M-350 was used in the breeding pens for three consecutive years (1943-45) and had twenty-nine pullet offspring. She had a different mate each year. All of her pullet progeny lived through the first laying year.

Male P-1024 had fifty-three pullets from eight of the hens to which he was mated. Only one of the pullets died during the first laying year. This was a progeny viability of 98.1 per cent for this male.

EGG PRODUCTION

In addition to selecting for viability, egg number also was given consideration. Egg production was calculated on the number of birds housed. At the beginning of the study, average production per bird for the first eight months was 135. Production increased to 164 eggs per bird during the same period for the last year of the study. A part of this increase must be attributed to the increase in viability.

EGG WEIGHTS

At the close of the experiment the average egg weight for the flock was approximately the same as it had been for the first year of the project. This information is given in Table 2. Egg weights were taken three times during the year. The first weight was taken in the fall after the pullets had been in porduction for two to three months. The other two weights were taken during the late winter and spring months. The minimum egg weight for breeders was set at 56 grams. Birds with egg weights under the minimum were eliminated from the breeding pens. There were some exceptions. A few good hens from outstanding families were used even though their egg weights were slightly below the standard.

Table 2. Average Flock Egg and Body Weights, 1938-47

Year	Egg Weight (Grams)	Body Weight (Pounds)
1938	57.41	3.98
1939	58.53	4.02
1940	58.23	4.00
1941	57.15	4.00
1942	55.76	4.00
1943	57.03	3.67
1944	56.66	3.91
1945	57.49	4.00
1946	57.91	3.72
1947	57.01	3.85

BODY WEIGHTS

Table 2 also shows there was little change in the body weight of the flock. Body weights given in Table 2 are the average bird weight for each year. They were obtained from two weights taken during the year — one in the fall, a month or two after the pullets had been housed, and the other during the following spring. The average body weight was fairly uniform for all years, except 1943 and 1946, when the weight dropped to 3.67 pounds and 3.72 pounds, respectively. No special attempt was made to increase body weight. The selection for egg weight, however, may have influenced this factor.

Discussion

It seems that laying house mortality may be reduced by selecting for viability on a family basis. Since laying house mortality markedly influences the profitableness of the poultry enterprise, it is feasible for poultry breeders to incorporate this method of selection in their breeding programs. Since trap nest and pedigree records are necessary for

this type of selection, it is not practical for commercial hatcheries (producers of a large majority of chicks) to do this type of selection in their supply flocks. It is possible, however, for commercial hatcheries to establish supply flocks from stock that has been improved for viability and egg production. Hatcheries could at least head their supply flocks with males that come from strains that have these desired characteristics.

There are at least three influences on egg production from this method of selection: (1) The best individuals in the flock for transmitting egg production are likely to be found, (2) hens that live longest are just allowed more time to lay eggs, and (3) the production of diseased birds is not likely to be normal for some time prior to death. Since egg production and viability play such an important role in poultry profits, poultry raisers should make every possible effort to obtain stock that have these qualities.

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